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INT CL^6 F16D 3/04 3/18 23/12 27/00 29/00 48/06 ,
F16H 19/00 19/04 25/14 61/28 61/30 61/32
ONLINE: WPI; EPODOC; JAPIO.

(54) Abstract Title
Automatic clutch or gearbox operating device with scroll and rack gearing

(57) An automatic operating device, for a clutch or gearbox in a drive train of a vehicle, comprises a toothed rod or rack 12 engaged with a scroll 11, eg having a square or triangular cross-section, formed on a disc 10 which is rotated, via gear wheels 6, 7, by an electric motor 2. The rotation of the disc 10 is transformed, via scroll 11, into longitudinal movement of the toothed rod 12 which forms an output element of the device. Longitudinal movement of the rod 12 may be perpendicular to an axis of the gear wheels 6, 7 or it may be at angle of, for example, between 85° and 60° (see angle γ, fig 3). Disc 10 may be integrally formed, eg by sintering, injection casting etc, with gear wheel 7. Externally toothed gear wheel 6 meshes with internally toothed gear wheel 7 and they may have axes which are non-parallel.

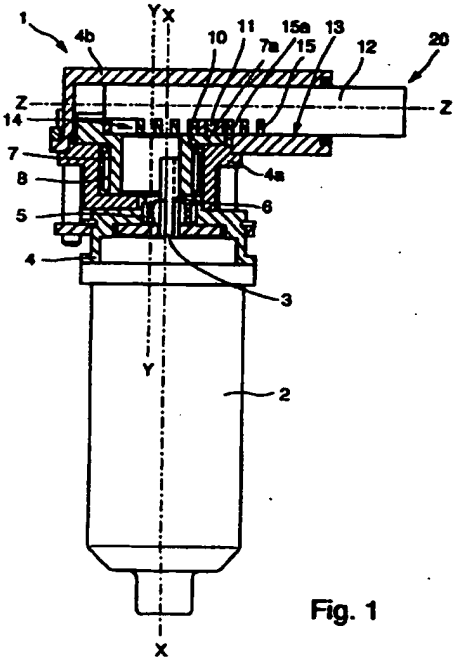


Fig. 1

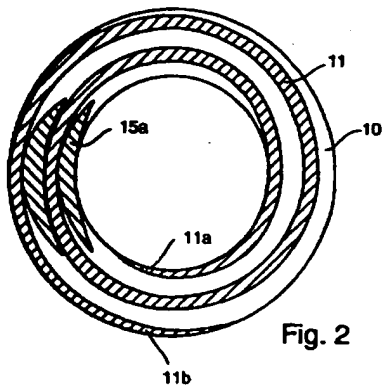


Fig. 2

GB 2 338 768 A

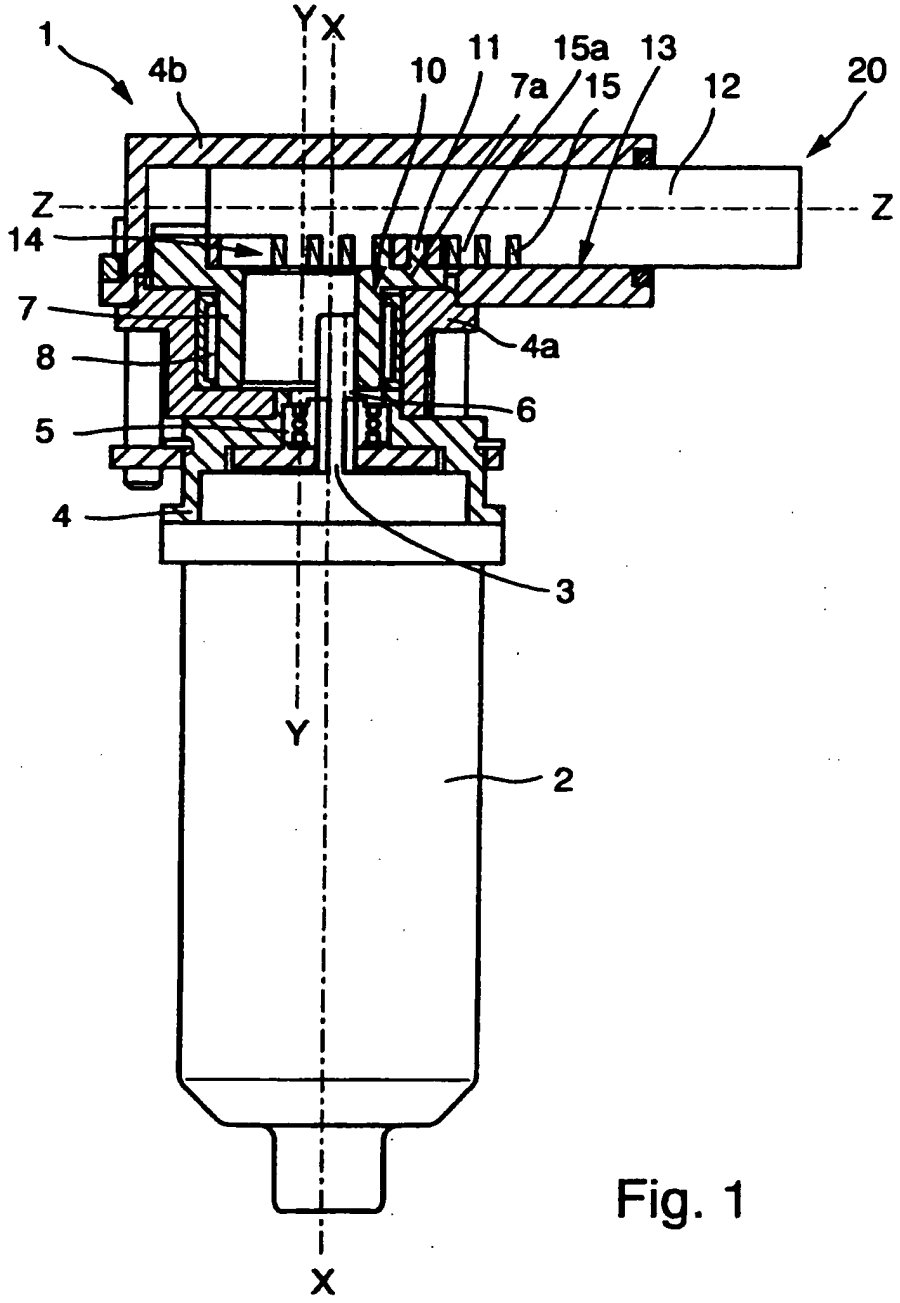


Fig. 1

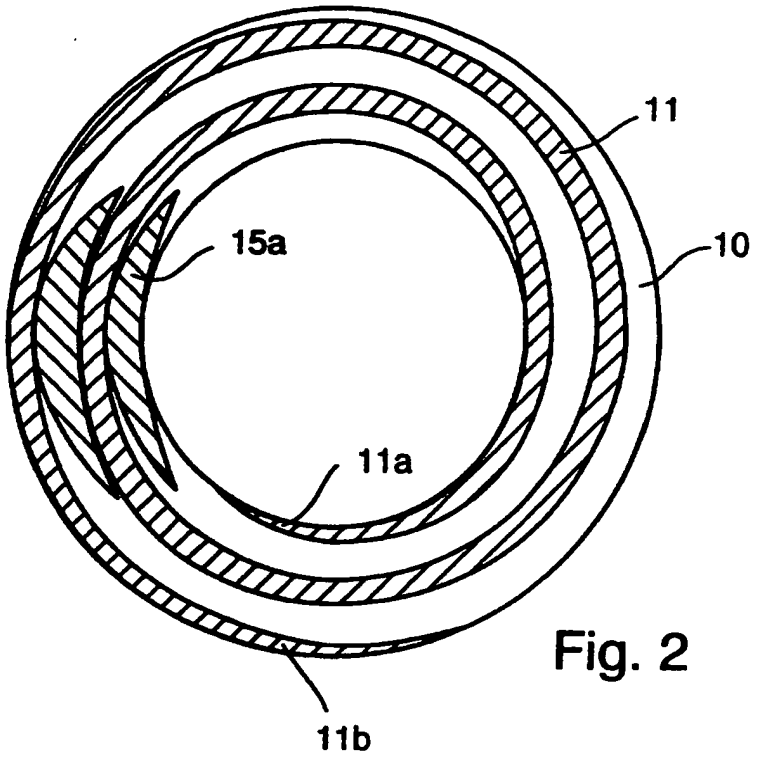


Fig. 2

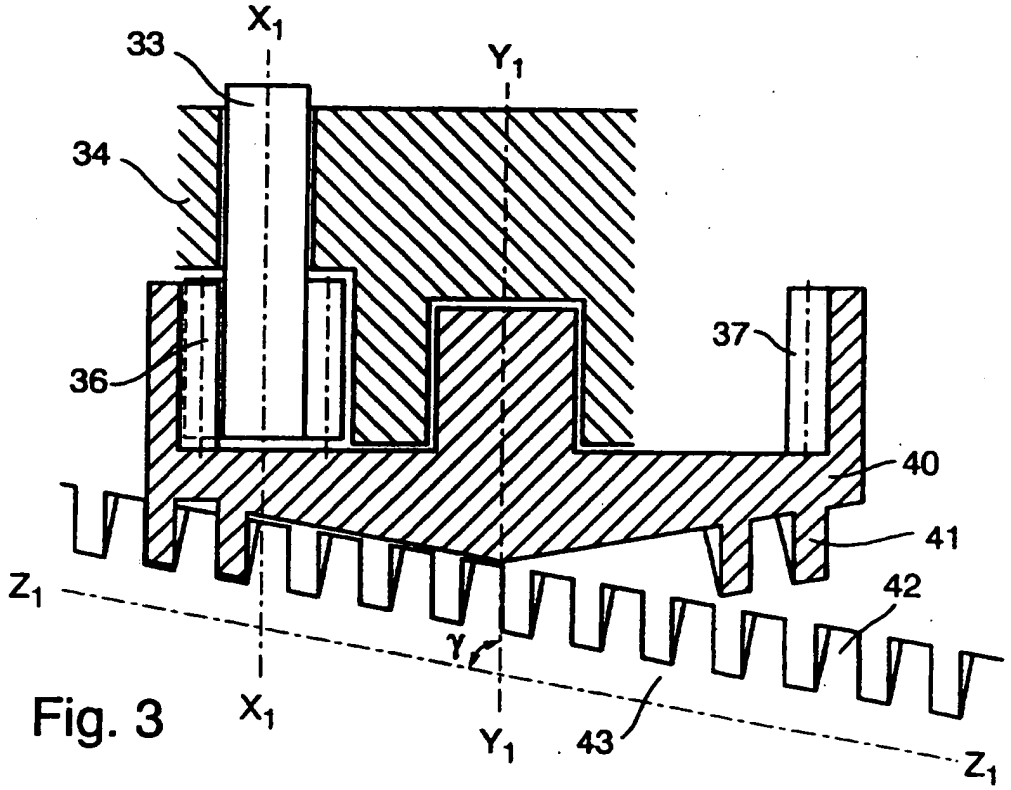


Fig. 3

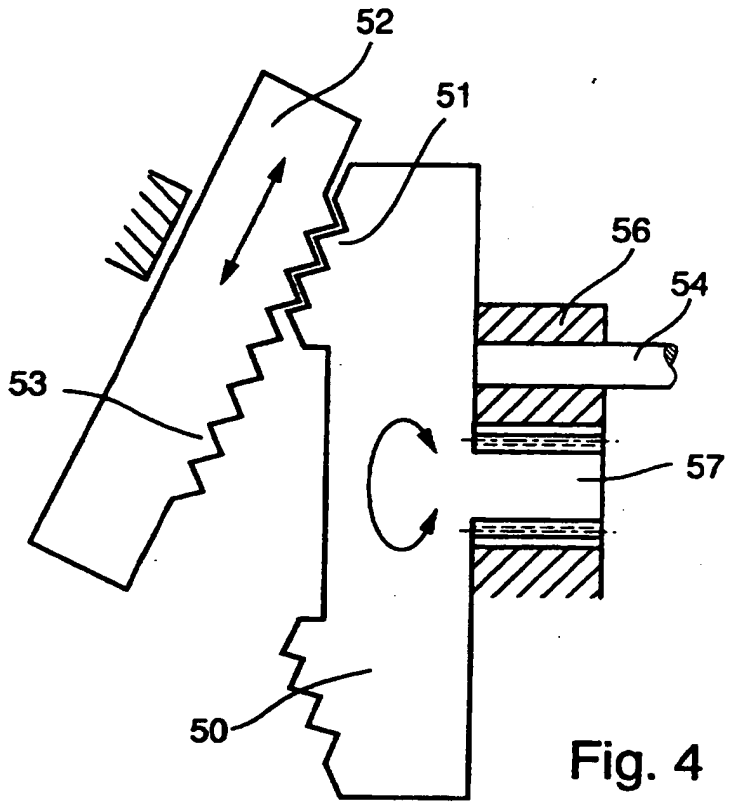


Fig. 4

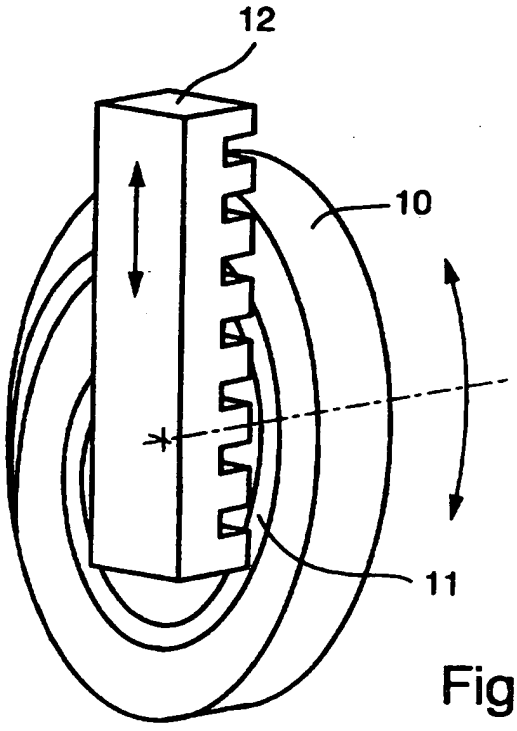
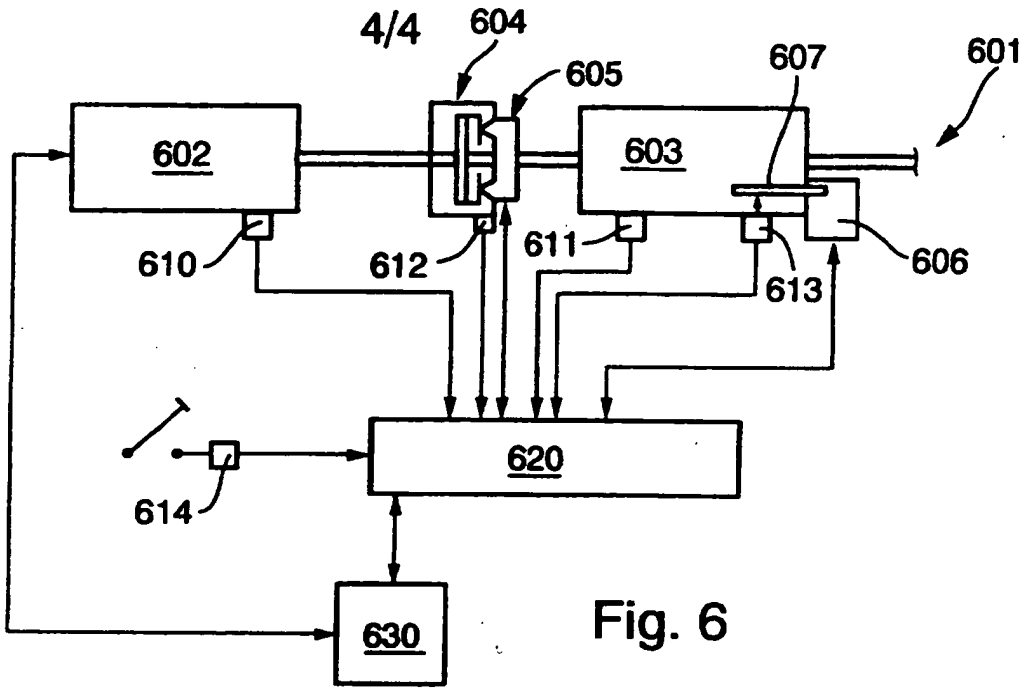


Fig. 5


604
605
607
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602
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610
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606
620
614
630

Fig. 6

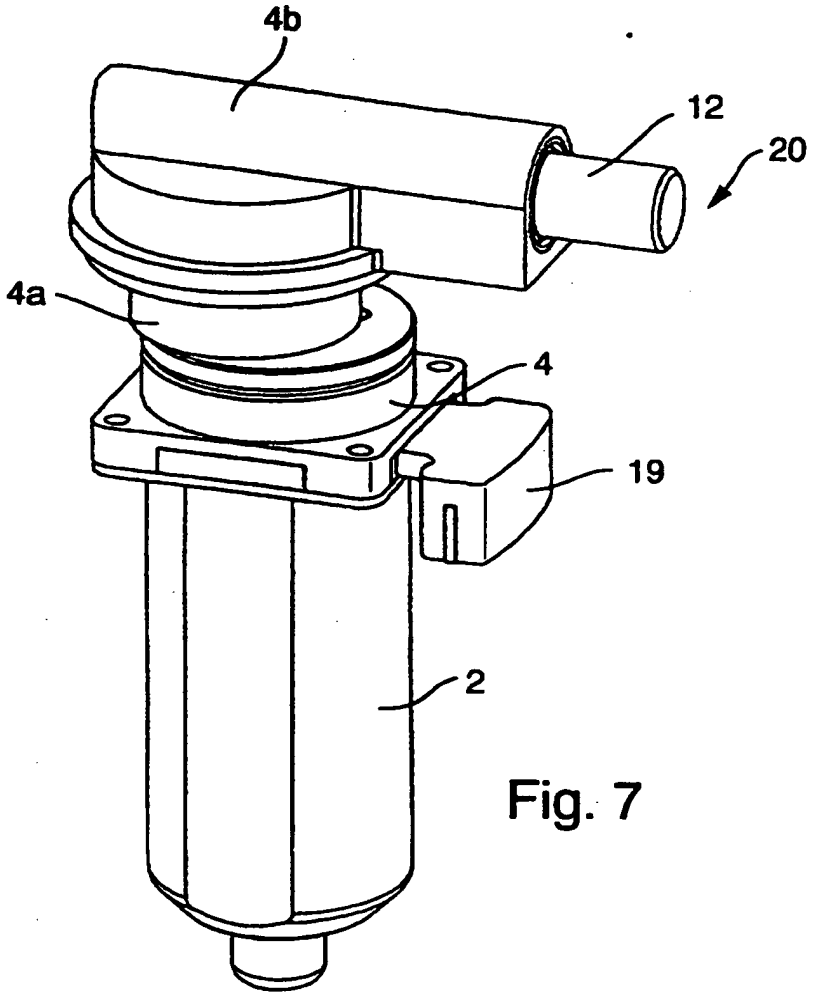
4b
12
20
4a
4
19
2

Fig. 7

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OPERATING DEVICE

The invention relates to an operating device for the automated operation of a clutch or a gearbox in the drive train of a motor vehicle, with a drive element which has a drive shaft and a first gearwheel mounted rotationally secured on this shaft, furthermore a second gearwheel is provided which is meshed by the first gearwheel.

Operating devices of this kind are known from DE 197 00 936. These devices are mounted coaxially relative to the gearbox input shaft of a vehicle transmission. This does not always allow a flexible arrangement of the device in the area of the vehicle transmission. Furthermore operating devices are known, see DE 195 04 487, where a worm gear and a crank assembly are linked together. Devices of this kind are as a rule formed to take up a great deal of structural space and do not always have a linear connection between the drive movement of the drive shaft and the output movement of the output element.

The object of the invention is to provide an operating device which is constructed in a space-saving yet simple manner and with fewer parts. At the same time it should be reached that the output movement is substantially proportional to the drive movement.

This is achieved according to the invention in that the second gear wheel has at one axial end area a disc-like element which supports a circumferential wedge, furthermore the device has a longitudinally displaceable toothed rod wherein at least a partial area of the circumferential wedge engages in the teeth of the toothed rod and the toothed rod forms the output element of the device.

It is advantageous if the circumferential wedge is mounted spirally on the disc-like element. It is likewise expedient if the circumferential wedge is mounted spirally on the disc-like element wherein the circumferential wedge increases its radius viewed from the centre point (axis) of the disc-like element during rotation about this axis. It is thereby further expedient if the circumferential wedge has a four-sided, rectangular or square cross-section or a triangular or rounded cross-section or a toothed profile.

It is thereby advantageous if the toothed rod has teeth with interposed tooth gaps in which at least a partial section of the circumferential wedge engages.

It is advantageous if the first and second gearwheel have axes which are aligned parallel with each other. A particularly space-saving design can thereby be characteristic.

It can likewise be expedient in a further embodiment if the first and second gearwheel have axes which are aligned at an angle other than 0 degrees or 180 degrees to each other.

It is expedient if the first gearwheel is an externally toothed gearwheel and the second gearwheel is an internally toothed gearwheel. It is likewise expedient if the first gearwheel is an externally toothed gearwheel and the second gearwheel is an externally toothed gearwheel. It is further expedient if the alignment of the longitudinal movement of the toothed rod on at least one axis of the first or second gearwheel or its projection into a plane containing the axes of the or each gearwheel

is substantially perpendicular. It is also advantageous if the alignment of the longitudinal movement of the toothed rod with at least one axis of the first or second gearwheel or its projection into a plane containing the axis of the or each gearwheel forms an angle substantially other than nil or ninety degrees.

It is particularly expedient if the drive element is an electric motor.

It is advantageous if the disc-like element supporting the circumferential wedge is formed as a sintered part. It is likewise expedient if the disc-like element supporting the circumferential wedge is formed as an injection cast part. Furthermore it is expedient if the disc-like element supporting the circumferential wedge is formed as an axially deformable part as far as possible without rear cut areas.

It is advantageous if the disc-like element supporting the circumferential wedge is formed integral with the second gearwheel.

It is likewise expedient if the disc-like element supporting the circumferential wedge is connected rotationally secured in keyed engagement with the second gearwheel.

Embodiments of the invention will now be explained in further detail with reference to the drawings in which:

Figure 1 is a sectional view of an operating device according to the invention;

Figure 2 is a plan view of the disc-like element supporting the circumferential wedge;

Figure 3 is a partial sectional view,
Figure 4 is a diagrammatic partial sectional view,
Figure 5 is a diagrammatic partial view,
Figure 6 is a diagrammatic illustration of a motor vehicle and
Figure 7 is a view of the device.

Figure 1 and Figure 5 each show an embodiment of an operating device 1 for the automated operation of a clutch 604 or a gearbox 603 in the drive train of a motor vehicle with a vehicle drive motor 602. This is shown diagrammatically in Figure 6.

The motor vehicle 601 further has an operating device 605 for the automated operation of the clutch 604 as well as an operating device 606 for the automated operation of at least one shift element 607 inside the gearbox for selecting the gear transmission ratio. Furthermore the device has a control unit 620 with micro processor and data memory to which sensors are attached. Furthermore an engine control unit 630 is in signal connection with the control unit 620 for the clutch and transmission control. As sensors are provided the engine speed sensor 610, the clutch path sensor 612, the gearbox speed sensor 611, the gearbox setting sensor 613 and the acceleration pedal position sensor 614.

The operating device 1 can be used both for operating the clutch and for operating the gearbox. The device 1 has a drive element 2 which has a drive shaft 3. The drive unit 2 is advantageously formed as an electric motor wherein the shaft 3 is the motor shaft. The device 1 has a housing 4 on which the motor 2 is fixed, such as screwed, so that the shaft 3 projects through an opening into the housing. The shaft 3 is mounted by means of the bearing 5

in the housing 4 and is held centred. The housing 4 can advantageously consist of more than one housing parts 4, 4a, 4b wherein the housing parts 4 and 4a can be formed in one piece. The connection between the housing parts can be produced through a releasable connection such as a screw connection. It can likewise take place through a non-releasable connection such as adhesive connection.

A first gearwheel 6 is provided on the shaft 3 and is mounted rotationally secured therewith. The gearwheel 6 is mounted rotatable relative to axis X-X whereby the axis X-X is at the same time also the rotational axis of the shaft 3. The gearwheel 6 can be connected rotationally secured to the shaft 3 or, in another advantageous embodiment, can be formed in one piece with the shaft 3.

The gearwheel 6 is formed in the embodiment of Figure 1 as an externally toothed gearwheel which meshes with a second gearwheel 7. The second gearwheel 7 is formed as an internally toothed gearwheel. The gearwheel 7 has a cylindrical part which has radially inside the teeth and radially outside a contact bearing face for holding the bearing 8. The second gearwheel 7 is housed mounted in the housing 4 by means of the bearing 8. The gearwheel 7 is mounted rotatable relative to its axis Y-Y. The axis Y-Y is mounted parallel to the axis X-X. The two axes are in this embodiment not coaxial. The gearwheels 6 and 7 are formed as spur wheels. When using for example conical gearwheels the axes can also be mounted at an angle other than nil or 180 degrees, as in the case of helical gears or hypoid gears for example.

The second gearwheel 7 has at an axial end area 7a a disc-like element 10 which supports a circumferential wedge 11 such as can be seen in Figure 2 in plan view. The

circumferential wedge 1 is mounted spirally on the disc-like element 10 and protrudes in the axial direction. The spiral path of the circumferential wedge 11 can clearly be seen in Figure 2. The circumferential wedge 11 starts in the radially inner area 11a of the circumferential wedge 11 and increases in its radius with an increasing turning angle viewed circumferentially until it has reached the radially outer area after about two revolutions at 11b. In a further advantageous embodiment the circumferential wedge can also extend only over about one revolution.

Furthermore the device 1 has a displaceable toothed rod 12 which is partially housed along its own axis Z-Z inside the housing 4 and partly extends out of the housing 4. The toothed rod 12 has on one of its side faces 13 teeth 14 whereby the circumferential wedge 11 engages in the tooth spaces 15 thereof. At least a partial area of the circumferential wedge 11 thereby engages in the teeth 14 of the toothed rod 12. The toothed rod 12 which during rotation of the gear wheel 7 is displaceable axially relative to its axis Z-Z forms the output element 20 of the device 1. The toothed rod 12 has an adjoining row of teeth 15a and tooth gaps 15 set in-between so that at least a partial section of the circumferential wedge 11 engages therein. The teeth 15a of the toothed rod 12 are shown as crescent-shaped teeth in Figure 2.

The circumferential wedge 11 is mounted spirally on the disc-like element 10 wherein the circumferential wedge 11 increases its radius viewed from the centre point (axis Y-Y) of the disc-like element 10 during rotation about the axis. The circumferential wedge is thereby advantageously formed integral with the element 10. It is expedient if the element 10 is formed with the circumferential wedge 11 as an injection cast part of plastics or metal.

The circumferential wedge has in Figure 1 a four-sided such as rectangular cross-section wherein in a further embodiment it can also be expedient if the cross-section is square, triangular or rounded.

With the device 1 it is particularly expedient if the first and second gearwheel (6, 7) have axes X-X, Y-Y which are aligned parallel with each other. Furthermore in a further advantageous embodiment it is expedient if the first gearwheel is an externally toothed gearwheel and the second gearwheel is an internally toothed gearwheel. In a further embodiment it can be expedient if the first gearwheel 56 is an externally toothed gearwheel and the second gearwheel 57 is an externally toothed gearwheel, see Figure 4. In the embodiment of Figure 1 the direction or alignment of the longitudinal movement Z-Z of the toothed rod 12 is perpendicular to at least one axis X-X, Y-Y of the first or second gearwheel 6,7 or its projection onto a plane which contains the or each axis is perpendicular to the axes.

The device of the embodiment according to Figure 3 or 4 shows a design where the axis Z_1-Z of the toothed rod 43 forms with at least one axis X_1-X_1, Y_1-Y_1 of the first or second gear wheel 36, 37 an angle other than nil or ninety degrees. The angle γ is preferably in the area around 75 #degrees, such as between 85 and 60 degrees. The angle can also be below 60 degrees, such as for example between 60 and 20 degrees, such as 45 degrees.

In the embodiment of Figure 3 the disc-like element 40 of the second gearwheel is connected in one piece with same and does not form as shown in Figure 1 a substantially flat surface but a conical surface on which the

circumferential wedge 41 is spirally arranged. This wedge 41 engages in the toothed gaps of the teeth 42 of the toothed rod 43. The gearwheel 36 is mounted the shaft 33 which is mounted inside the housing 34. The gearwheel 36 is formed as an externally toothed gearwheel and the gearwheel 37 is formed as an internally toothed gearwheel.

It is particularly advantageous if the disc-like conical element 40 supporting the circumferential wedge 41 is formed integral with the second gearwheel 37. It is also expedient if the disc-like element supporting the circumferential wedge is connected rotationally secured in keyed engagement with the second gearwheel.

In the embodiment of Figure 4 the disc-like element 50 of the second gearwheel 57 is connected in one piece with same and does not form as shown in Figure 1 a substantially flat surface but a conical surface on which the circumferential wedge 51 is spirally arranged. This wedge 51 engages in the tooth gaps of the teeth 53 of the toothed rod 52. The gearwheel 56 is mounted the shaft 54 which is mounted inside the housing. The gearwheel 56 is formed as an externally toothed gearwheel and the gearwheel 57 is formed as an externally toothed gearwheel.

Figure 7 shows a view of the device 1 according to the invention with the housing of the motor 2, the housing 4 and the toothed rod 12 as an output element 20 of the device. The output movement of the toothed rod 12 is aligned substantially at right angles to the shaft of the motor 2 and has a round cross-section wherein this can also be formed rectangular or oval. Furthermore Figure 7 shows a socket 19 of a plug connection for the electric supply to the electric motor 2.

The patent claims filed with the application are proposed wordings without prejudice for obtaining wider patent protection. The applicant retains the right to claim further features disclosed up until now only in the description and/or drawings.

References used in the sub-claims refer to further designs of the subject of the main claim through the features of each relevant sub-claim; they are not to be regarded as dispensing with obtaining an independent subject protection for the features of the sub-claims referred to.

The subjects of these sub-claims however also form independent inventions which have a design independent of the subjects of the preceding claims.

The invention is also not restricted to the embodiments of the description. Rather numerous amendments and modifications are possible within the scope of the invention, particularly those variations, elements and combinations and/or materials which are inventive for example through combination or modification of individual features or elements or process steps contained in the drawings and described in connection with the general description and embodiments and claims and which through combinable features lead to a new subject or to new process steps or sequence of process steps insofar as these refer to manufacturing, test and work processes.

Claims

1. Operating device for the automated operation of a clutch or a gearbox in the drive train of a motor vehicle, with a drive element which has a drive shaft and a first gearwheel mounted rotationally secured on this shaft, furthermore a second gearwheel is provided which is meshed by the first gearwheel, the second gearwheel has at one axial end area a disc-like element which supports a circumferential wedge, furthermore the device has a longitudinally displaceable toothed rod wherein at least a partial area of the circumferential wedge engages in the teeth of the toothed rod and the gear rod forms the output element of the device.

2. Device according to claim 1 characterised in that the circumferential wedge is mounted spirally on the disc-like element.

3. Device according to claim 1 characterised in that the circumferential wedge is mounted spirally on the disc-like element wherein the circumferential wedge increases its radius viewed from the centre point (axis) of the disc-like element during rotation about this axis.

4. Device according to claim 1, 2 or 3 characterised in that the circumferential wedge has a four-sided, rectangular or square cross-section or a triangular or rounded cross-section or another toothed profile.

5. Device according to claim 1 characterised in that the toothed rod has teeth with interposed tooth gaps in which at least a partial section of the circumferential wedge engages.

6. Device according to claim 1 characterised in that the first and the second gearwheel have axes which are aligned parallel with each other.

7. Device according to claim 1 characterised in that the first and the second gearwheel have axes which are aligned relative to each other at an angle not equal to 0 degrees or not equal to 180 degrees.

8. Device according to claim 1 characterised in that the first gearwheel is an externally toothed gearwheel and the second gearwheel is an internally toothed gearwheel.

9. Device according to claim 1 characterised in that the first gearwheel is an externally toothed gearwheel and the second gearwheel is an externally toothed gearwheel.

10. Device according to claim 1 characterised in that the alignment of the longitudinal movement of the toothed rod with at least one axis of the first or second gearwheel is substantially perpendicular.

11. Device according to claim 1 characterised in that the alignment of the longitudinal movement of the toothed rod with at least one axis of the first or second gearwheel forms an angle substantially other than nil or ninety degrees.

12. Device according to claim 1 characterised in that the drive element is an electric motor.

13. Device according to claim 1 characterised in that the disc-like element supporting the circumferential wedge is formed integral with the second gearwheel.

14. Device according to claim 13 characterised in that the disc-like element supporting the circumferential wedge is made as a sintered part.

15. Device according to claim 13 characterised in that the disc-like element supporting the circumferential wedge is formed as an injection cast part.

16. Device according to claim 13, 14 or 15 characterised in that the disc-like element supporting the circumferential wedge is formed as an axially deformable part.

17. Device according to claim 1 characterised in that the disc-like element supporting the circumferential wedge is connected rotationally secured in keyed engagement with the second gearwheel.

18. Operating device for the automated operation of a clutch or a gearbox in the drive train of a motor vehicle, substantially as herein described with reference to the accompanying drawings.

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Application No:	GB 9906663.1	**Examiner:**	Mike McKinney
Claims searched:	1 to 18	**Date of search:**	21 October 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): F2D; F2L; F2Q.

Int Cl (Ed.6): F16D 3/04, 3/18, 23/12, 27/00, 29/00, 48/06; F16H 19/00, 19/04, 25/14, 61/28, 61/30, 61/32.

Other: ONLINE: WPI; EPODOC; JAPIO.

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
Y	WO 90/05251 A	(GERISCH) see figs.	1 to 17.
Y	US 5186532	(RYDER et al) see figs.	1 to 17.
Y	US 4852419	(KITTEL et al) see figs.	1 to 17.

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.